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(54) Drying circuit for dry-cleaning machines, using N-propyl bromide solvent

(57) A drying circuit for dry-cleaning machines using n-propyl bromide solvent, consisting of the fact that the coil (11) of a refrigeration unit is immersed in the primary solvent tank (9). At top ends thereof the tank (9) is connected to the drum (2) with pipes (12,13,14,15) for the passage of the drying air, the free surface of the solvent in the tank (9) constituting a cooling agent for the air.

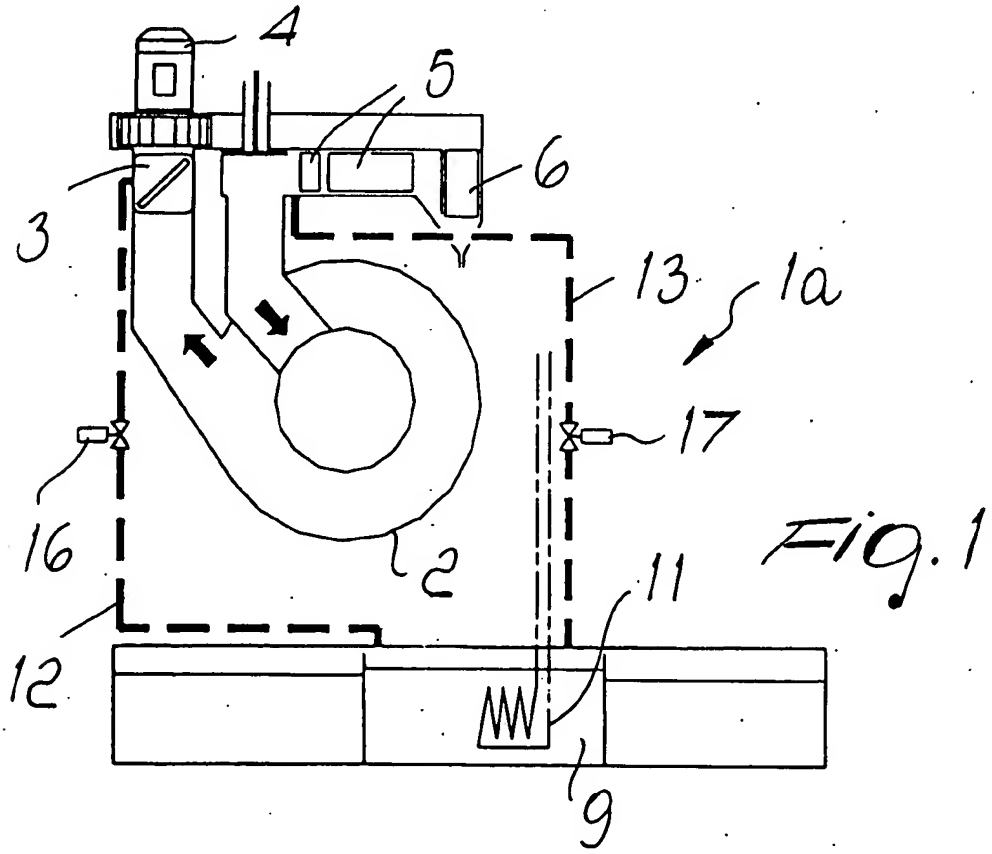

Fig. 1

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Description

[0001] The present invention relates to a drying circuit for dry-cleaning machines using n-propyl bromide solvent.

[0002] The dry-cleaning industry has long been conducting research into replacing perchloroethylene, which is the most widely used solvent.

[0003] This solvent, introduced in dry cleaning in the mid-1960s, monopolized the market thanks to its valid characteristics. However, toxicological studies on perchloroethylene immediately demonstrated the high toxicity of the solvent, especially as regards pollution of groundwater.

[0004] Although its use was not prohibited, it was in practice prevented, since purchase of expensive machines and compliance with very precise and onerous safety standards were required.

[0005] The dry-cleaning industry reacted by proposing alternative machines and solvents, such as for example hydrocarbon solvents.

[0006] These solvents are perfectly compatible from the environmental standpoint and in some cases are even biodegradable; however, they have the following drawbacks:

- they are flammable and therefore the machines must comply with very specific safety standards;
- their degreasing power is considerably limited and it is therefore necessary to resort to considerable quantities of washing reinforcers;
- the evaporation rate of this solvent is relatively high and therefore the drying times are significantly longer than in perchloroethylene machines;
- in order to limit drying times, it is convenient to spin-dry at high speeds, and this forces the introduction of oscillating-drum technology, with consequent cost increases;
- distillation requires vacuum technology, with a further cost increase.

[0007] Hence, in order to solve one problem, in practice, other problems have been introduced which relate to aspects that are anything but secondary, such as the inherent safety and cost of the machines.

[0008] This is the context in which a new solvent, an n-propyl bromide, such as that marketed by Comeco 2 under the registered trademark Comexol One, is used. This solvent has the following advantages:

- its toxicity is lower than that of perchloroethylene, although it is not fully biodegradable like hydrocarbon solvents;
- risk: none at least against the atmospheric ozone layer;
- flammability: none;
- very high degreasing power: even higher than that of perchloroethylene; the need for reinforcers is therefore limited and washing times are usually shorter;
- evaporability rate: lower than that of perchloroethylene;

thanks to this characteristic, the drying times are extremely short in absolute terms.

[0009] The boiling point is relatively low (69 °C against 121 °C of perchloroethylene and 190-200 °C of hydrocarbon). This simplifies the design of the heat exchangers, since the working pressures of the heating fluid are lower.

[0010] The only drawback of this solvent is its vapor pressure, which is slightly higher than that of perchloroethylene (110 mm Hg versus 14 mm Hg).

[0011] In ordinary conditions, dry-cleaning machines that work with this solvent are subjected to a moderate working pressure.

[0012] The aim of the present invention is to provide a drying circuit for dry-cleaning machines using n-propyl bromide solvent in which the vapor pressure of the solvent has negligible values. It is taken into consideration that with this low order of magnitude of vapor pressure the condensation of the solvent, especially at the end of the drying step, when the vapors inside the drying tunnel have rarefied and the concentration is therefore lower, can be difficult.

[0013] Within this aim, an object of the present invention is to provide a structure that is simple, relatively easy to provide in practice, safe in use, effective in operation, and has a relatively low cost.

[0014] This aim and this and other objects that will become better apparent hereinafter are achieved by the present drying circuit for dry-cleaning machines using n-propyl bromide solvent, characterized in that the coil of a refrigeration unit is immersed in the primary solvent tank and in that at the top end thereof said tank is connected to the drum with pipes for the passage of the drying air, the free surface of the solvent in the tank constituting a cooling agent for the air.

[0015] Further characteristics and advantages of the invention will become better apparent from the following detailed description of a preferred but not exclusive embodiment of a drying circuit for dry-cleaning machines using n-propyl bromide solvent according to the invention, illustrated only by way of non-limitative example in the accompanying drawings, wherein:

Figure 1 is a schematic view of a drying circuit for dry-cleaning machines for n-propyl bromide solvent according to the invention;
Figure 2 is a schematic view of an alternative version of the circuit of Figure 1.

[0016] With reference to the figures, the reference numerals 1a, 1b generally designate a drying circuit for dry-cleaning machines using n-propyl bromide solvent according to the invention.

[0017] In the figures, the following components of a dry-cleaning machine have been shown schematically: the washing drum 2, the lint filter 3, the fan 4, the heaters 5, the condenser 6, the drum entry duct 7, the drum exit duct 8, the central or primary solvent tank 9, and the optional secondary solvent tanks 10a and 10b.

[0018] The coil 11 of a refrigeration unit (which can be for example the coil of the dry-cleaning machine used in the drying step) is immersed in the solvent tank 9, and at the top end thereof the tank 9 is connected to the drum with pipes for the passage of the drying air.

[0019] The circuit 1a according to the invention, shown in Figure 1, comprises, in particular, a pipe 12 for connection between the tank 9 and the intake of the fan 4 and a pipe 13 for return to the tank, which is provided from directly downstream of the heaters 5 to the primary tank 9.

[0020] An alternative circuit 1b, shown in Figure 2, has a pipe 14 for connection between the delivery of the fan and the tank 9 and a pipe 15 for the return connection from the tank 9 to a region downstream of the heaters 5 of the drying tunnel.

[0021] It is possible to install, along the pipes 12, 13, 14 and 15, respective valves 16, 17, 18, 19, with different actuation periods, with the aim of optimizing operation.

[0022] The presence of solvent at low temperature in the tank 9 (between 0 and -20 °C) causes the vapor pressure to be kept within very low values, such as to limit the evaporation of the solvent to truly low levels.

[0023] Since the lateral tanks 10 and 11 are in contact with the cooled tank 9 by means of metal walls, they too are cooled, with evident benefits from the standpoint of vapor pressure limitation.

[0024] Secondly, the double pipe that connects the drying circuit tunnel to the tank acts so that the air stream that exits from the drum, which is saturated with solvent to be condensed, is actually divided into two fractions, the main fraction entering the machine condenser, the secondary fraction being directed toward the cooled or cold tank 9, which thus acts as an additional condenser.

[0025] It has thus been shown that the invention achieves the intended aim and object.

[0026] The invention thus conceived is susceptible of numerous modifications and variations, all of which are within the scope of the appended claims.

[0027] All the details may further be replaced with other technically equivalent ones.

[0028] In practice, the materials used, as well as the shapes and dimensions, may be any according to requirements without thereby abandoning the scope of the protection of the appended claims.

[0029] The disclosures in Italian Patent Application No. BO2001A000605 from which this application claims priority are incorporated herein by reference.

[0030] Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly, such reference signs do not have any limiting effect on the interpretation of each element identified by way of example by such reference signs.

Claims

1. A drying circuit for dry-cleaning machines using n-propyl bromide solvent, **characterized in that** the coil (11) of a refrigeration unit is immersed in the primary solvent tank (9) and **in that** at the top end thereof said tank (9) is connected to the drum (2) with pipes (12,13,14,15) for the passage of the drying air, the free surface of the solvent in the tank (5) constituting a cooling agent for the air.

2. The circuit according to claim 1, **characterized in that** it comprises a connecting pipe (12) arranged between the tank (9) and the intake of the fan (4) and a pipe (13) for return to the tank (9) that runs from directly downstream of the heaters (5) to the primary tank (9).

3. The circuit according to claim 1, **characterized in that** it comprises a connecting pipe (14), which is arranged between the delivery of the fan (4) and the tank (9), and a pipe (15) for a return connection, which is arranged between the tank (9) and a region downstream of the heaters (5) of the drying circuit.

4. The circuit according to one or more of the preceding claims, **characterized in that** respective valves (16,17,18,19) having different actuation periods, suitable to optimize operation, are fitted along one or more of said pipes (16,17,18,19).

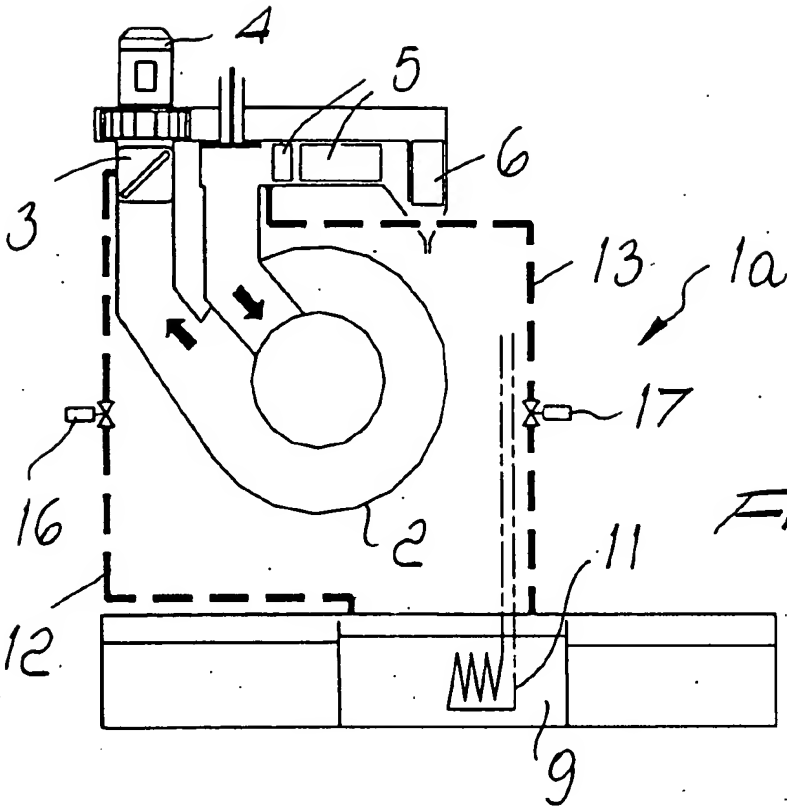

Fig. 1

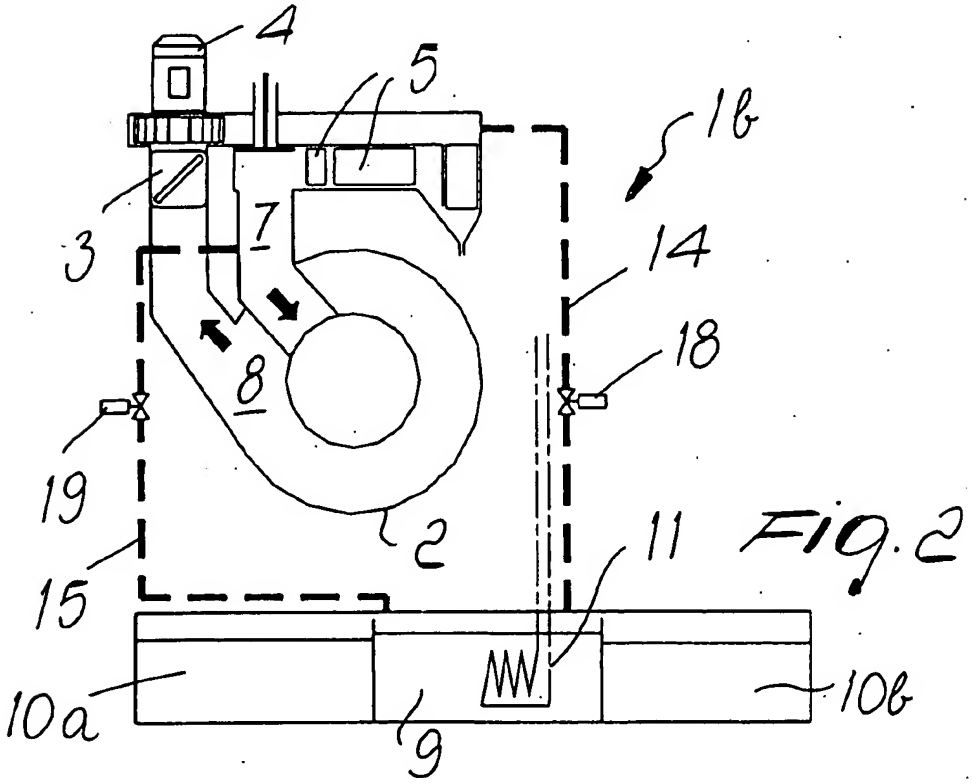

Fig. 2

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EUROPEAN SEARCH REPORT

Application Number
EP 02 02 1312

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X Y	US 3 302 300 A (MCCLEAD ALPHEUS E) 7 February 1967 (1967-02-07) * column 1, lines 35 - 40 and 60 - 65; figure *	1 3,4	D06F43/08
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TECHNICAL FIELDS SEARCHED (Int.Cl.7)

D06F
D06L
D06M

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
MUNICH	22 January 2003	Cagnoli, M

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

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EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 02 02 1312

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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22-01-2003

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